

CLAIMS

1. A method making a magnetic head assembly that has an air bearing surface (ABS) comprising the steps of:

making a read head comprising the steps of:

5 forming a read sensor;

forming a hard bias structure magnetically coupled to the read sensor for longitudinally biasing the read sensor;

10 applying a first magnetic field to the hard bias structure for orienting magnetic spins of the hard bias structure in a first direction that is parallel to said ABS and parallel to major thin film planes of layers of the read sensor; and

applying a second magnetic field to the hard bias structure in a direction that is antiparallel to said first direction.

15 2. A method making a magnetic head assembly as claimed in claim 1 further applying one more additional magnetic fields parallel to the ABS and parallel to major thin film planes of the layers of the sensor provided each additional application of a magnetic field is oriented antiparallel to a previous application of a magnetic field.

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3. A method making a magnetic head assembly as claimed in claim 1 including the steps of:

forming the magnetic head assembly as one magnetic head assembly of a plurality of magnetic head assemblies in rows and columns on a wafer;

25 dicing the wafer into rows of magnetic head assemblies wherein one of the row of magnetic head assemblies includes said magnetic head assembly;

dicing the row of magnetic head assemblies into individual magnetic head assemblies where one of the individual magnetic head assemblies is said one magnetic head assembly;

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mounting said one magnetic head assembly on a head gimbal assembly (HGA); and

applying said first magnetic field to said wafer and then applying said second magnetic field to said HGA.

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4. A method making a magnetic head assembly as claimed in claim 3 further comprising the steps of:

mounting the HGA on a head stack assembly (HSA); and
mounting the HSA in a magnetic disk drive.

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5. A method making a magnetic head assembly as claimed in claim 3 wherein a making of the read sensor includes the steps of:

forming a ferromagnetic pinned layer that has a magnetic moment;
forming an antiferromagnetic pinning layer exchange coupled to the pinned
15 layer for pinning the magnetic moment of the pinned layer perpendicular to the ABS;
forming a ferromagnetic free layer that has a magnetic moment that is oriented
parallel to the ABS and parallel to said major thin film planes of the sensor layers;
and
forming a nonmagnetic spacer layer between the free layer and the pinned
20 layer.

6. A method making a magnetic head assembly as claimed in claim 5 further comprising the steps of:

making a write head including the steps of:
25 forming ferromagnetic first and second pole piece layers in pole tip,
yoke and back gap regions wherein the yoke region is located between the
pole tip and back gap regions;
forming a nonmagnetic electrically nonconductive write gap layer
between the first and second pole piece layers in the pole tip region;

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forming an insulation stack with at least one coil layer embedded therein between the first and second pole piece layers in the yoke region; and connecting the first and pole piece layers at said back gap region.

5 7. A method making a magnetic head assembly as claimed in claim 6 wherein the step of forming said hard bias structure includes the step of forming first and second hard bias layers adjacent first and second side surfaces of the sensor wherein the first and second side surfaces are perpendicular to the ABS.

10 8. A method making a magnetic head assembly as claimed in claim 1 including the steps of:

 forming the magnetic head assembly as one magnetic head assembly of a plurality of magnetic head assemblies in rows and columns on a wafer; and
 applying said first and second magnetic fields to said wafer;

15 9. A method making a magnetic head assembly as claimed in claim 1 including the steps of:

 forming the magnetic head assembly as one magnetic head assembly of a plurality of magnetic head assemblies in rows and columns on a wafer;

20 dicing the wafer into rows of magnetic head assemblies wherein one of the row magnetic head assemblies includes said magnetic head assembly; and

 applying said first magnetic field to said wafer and applying said second magnetic field to said one row of magnetic head assemblies.

25 10. A method making a magnetic head assembly as claimed in claim 1 wherein a making of the read sensor includes the steps of:

 forming a ferromagnetic pinned layer that has a magnetic moment;
 forming an antiferromagnetic pinning layer exchange coupled to the pinned layer for pinning the magnetic moment of the pinned layer perpendicular to the ABS;

forming a ferromagnetic free layer that has a magnetic moment that is oriented parallel to the ABS and parallel to said major thin film planes of the sensor layers; and

5 forming a nonmagnetic spacer layer between the free layer and the pinned layer;

the making of the write head includes the steps of:

forming ferromagnetic first and second pole piece layers in pole tip, yoke and back gap regions wherein the yoke region is located between the pole tip and back gap regions;

10 forming a nonmagnetic electrically nonconductive write gap layer between the first and second pole piece layers in the pole tip region;

forming an insulation stack with at least one coil layer embedded therein between the first and second pole piece layers in the yoke region; and

connecting the first and pole piece layers at said back gap region; and

15 wherein the step of forming said hard bias structure includes the step of forming first and second hard bias layers adjacent first and second side surfaces of the sensor wherein the first and second side surfaces are perpendicular to the ABS.

11. A method making a magnetic head assembly as claimed in claim 10
20 including the steps of:

forming the magnetic head assembly as one magnetic head assembly of a plurality of magnetic head assemblies in rows and columns on a wafer;

dicing the wafer into rows of magnetic head assemblies wherein one of the row magnetic head assemblies includes said magnetic head assembly;

25 dicing the row of magnetic head assemblies into individual magnetic head assemblies where one of the individual magnetic head assemblies is said one magnetic head assembly;

mounting said one magnetic head assembly on a head gimbal assembly (HGA); and

applying said first and second magnetic fields at any one of the wafer, row, individual or HGA level of said one magnetic head assembly or applying the first magnetic field to any one of the wafer, row, individual or HGA level of said one magnetic head assembly and the second magnetic field to any other one of the wafer, 5 row, individual or HGA level of said one magnetic head assembly.

12. A method making a magnetic head assembly as claimed in claim 11 further comprising the steps of:

- 10 mounting the HGA on a head stack assembly (HSA); and
 mounting the HSA in a magnetic disk drive.

13. A method making a magnetic head assembly as claimed in claim 12 further applying one more additional magnetic fields parallel to the ABS and parallel 15 to major thin film planes of the layers of the sensor provided each additional application of a magnetic field is oriented antiparallel to a previous application of a magnetic field.

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